Space Weather Technical Forecast

Issued on Wednesday, 30 November 2022 at 00:17 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1/Minor Geomagnetic Storm intervals through the period. Chance of Active electron fluence from day 1 (30th).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low in the past 24 hours, with a single long duration C4.2 flare from AR3151 near the west limb peaking at 29/1358 UTC. There is one other active region on the visible disk, AR3152 in the northwest appears weak and stable.
No new Earth-directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar wind parameters, as measured by ACE and DSCOVR at L1, were indicative of positive coronal hole High Speed Stream influences. Solar wind speeds were initially elevated, between 550-600 km/s before increasing to strong levels between 600-700 km/s. Density was around average or slightly above. The IMF, Bt, has been weak at or below 8 nT. The north south component ranged from +6/-7 nT with some long periods negative. The phi angle was predominantly positive (away from the Sun). Geomagnetic activity was mostly Unsettled to Active (Kp 3-4).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) as measured at GOES16 has remained at Background levels. High energy electron flux (greater than 2MeV) at GOES16 was at Background to Moderate levels before becoming High from 29/1355 UTC. Observed fluence at 30/0001 UTC was 6.9e7 integrated pfu.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to remain Very Low over the forecast period, with a chance of isolated C-class flares, and just a very slight chance of isolated M-flares.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are expected during the period. Solar winds are currently elevated due to the connection to CH49/+. The next solar wind enhancement is expected either late on day 1 (30th Nov) or early on day 2 (1st Dec) due to the arrival of the HSS from CH51/+.
Geomagnetic activity is expected to be Unsettled (Kp 3) to Active (Kp 4), with a chance of isolated G1/Minor storm (Kp 5) intervals. The chance for G1 is greatest from late day 1 (30th) or during day 2 (1st) due to the arrival of the large CH51/+.

Energetic Particles / Solar Radiation: High energy electron flux (greater than 2 MeV), observed by GOES16, and is expected to show a variable trend in coming days. Flux levels are expected to become high during the diurnal maximum through the period. Though they may become suppressed at times due to geomagnetic activity.
Fluence levels are below the 1e8 integrated electron fluence active threshold, but are on a slow but steady rise. An overall rising trend is probable through day 1 (30th), with a chance of reaching above the active threshold for the remainder of the period.

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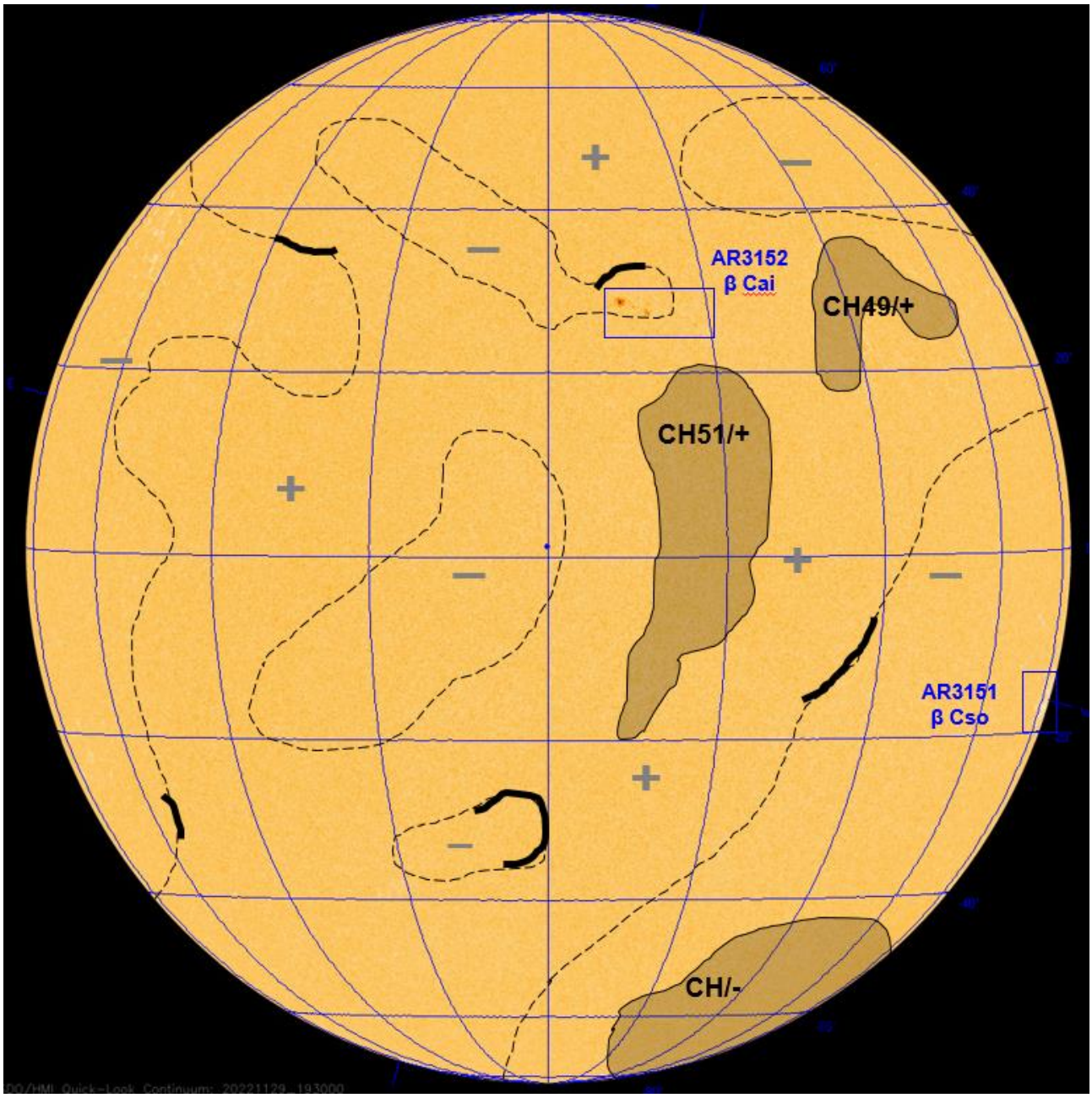
Figure 1. Solar Analysis Valid 29/1930 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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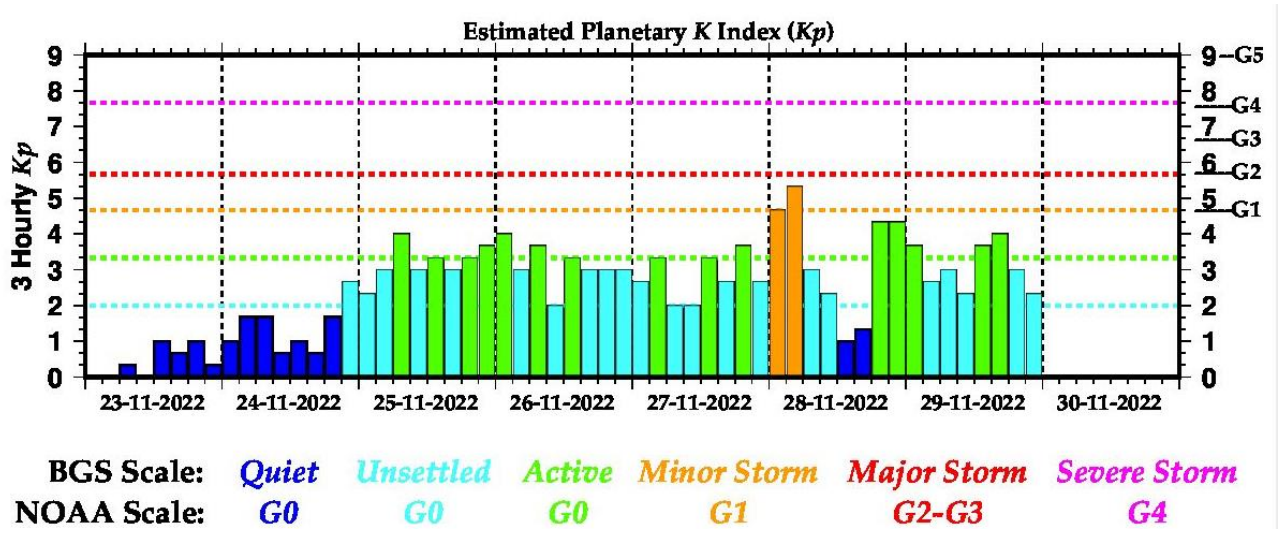
Geomagnetic Storms:

No Earth-directed CMEs are expected during the period.
Solar winds are currently strong due to the connection with coronal hole 49. The next solar wind enhancement is expected either late on day 1 (30th Nov) or early on day 2 (1st Dec) due to the arrival of the high speed stream from coronal hole 51. This is a recurring feature, with solar winds peaking at around 550-600 km/s on the previous rotation. Similar, perhaps faster (550-650 km/s) solar winds can be expected due to the apparent increase in size and darkening of this of this feature on the SO-193 imagery.
Geomagnetic activity is expected to be Unsettled to Active with a chance of isolated G1/Minor storm intervals. The chance for G1 is greatest from late day 1 (30th) or during day 2 (1st) due to the arrival of the large coronal hole 51/+.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	40	40	30	30
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections - Nil

Figure 2: BGS Planetary K index (Kp)


Estimated Planetary K Index (Kp)
3 Hourly Kp
9 8 7 6 5 4 3 2 1 0
G5 G4 G3 G2 G1
23-11-2022 24-11-2022 25-11-2022 26-11-2022 27-11-2022 28-11-2022 29-11-2022 30-11-2022
BGS Scale: Quiet Unsettled Active Minor Storm Major Storm Severe Storm
NOAA Scale: G0 G0 G0 G1 G2-G3 G4

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Radio Blackouts - X-Ray Flares:

Solar activity is forecast to remain Very Low over the forecast period, with a chance of isolated C-class flares, and just a very slight chance of isolated M-flares.
There are currently two numbered sunspot regions on the visible disc, with AR3151 about to rotate out of view around the southwest limb. AR3152 is now centre disc in the northern hemisphere. Both regions appear relatively stable and small.

Far-sided seismic data suggests a couple of possible active regions returning around the east limb during the period. Probabilities are being maintained until these possible active regions emerge onto the visible disc.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**R1-R2 M Class**	No	5	5	5	5
Very Active	**R3 to R5 X Class**	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10MeV) at GEO, as observed by GOES16 is currently at background levels and is expected to remain at this level throughout.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2 MeV), observed by GOES16, has shown a steadily increasing trend having increased above the high threshold from 29/1355 UTC. It has remained mostly just above this threshold. This has been a result of the relaxing of the Van Allen belts post charging event from coronal hole 49. A re-compression is then expected due to the arrival of coronal hole 51 late day 1 (30th) or on day 2 (1st). Confidence is relatively low due to uncertainty surrounding possible geomagnetic responses during the arrival of CH51 HSS, as well as any activity due to the ongoing strong winds. However, it is likely that the High threshold (1e3 pfu) will be breached each day during the diurnal maximum.
Fluence levels are below the 1e8 integrated electron fluence active threshold, however they are on a slow but steady rise, with a chance of reaching above the active threshold each day.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	30	30	40	40
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 3: GOES16 ElectronFlux levels

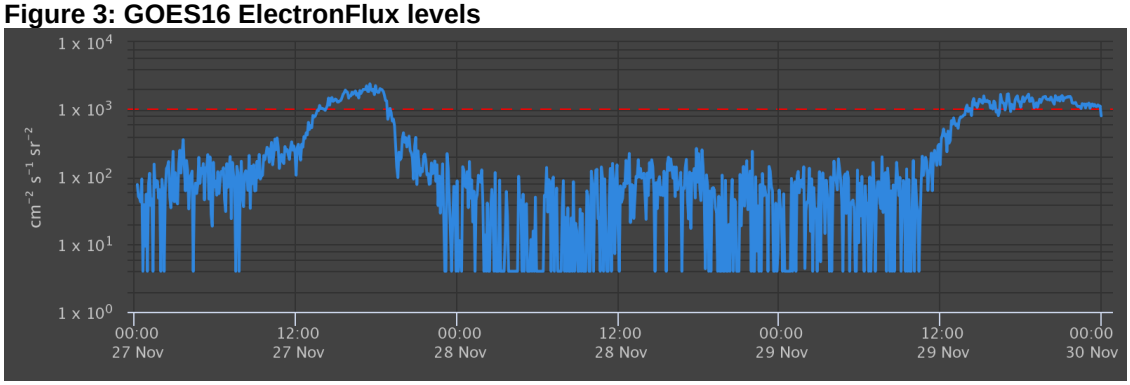
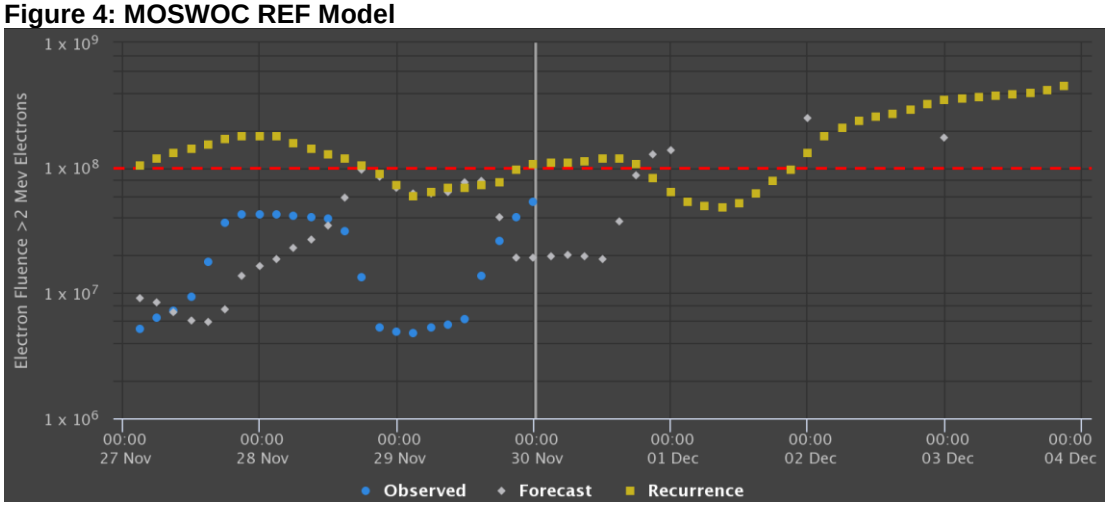


Figure 4: MOSWOC REF Model



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